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Change in Teacher Efficacy and Student Self- and Task-Related Beliefs in Mathematics During the Transition to Junior High School

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In a longitudinal study of 1,329 students and the teachers they had for mathematics before and after the transition to junior high school, the relation between students' beliefs in mathematics and their teachers' sense of efficacy is examined. Using repeated measures multivariate analysis of variance, we found that the rate of change within the school year in students' expectancies, perceived performance, and perceived task difficulty in math differed at Years 1 and 2, depending on teacher efficacy before and after the transition. Students who moved from high- to low-efficacy math teachers during the transition ended the junior high year with the lowest expectancies and perceived performance (even lower than students who had low efficacy teachers both years) and the highest perceptions of task difficulty. The differences in pre- and posttransition teachers' views of their efficacy had a stronger relationship to low-achieving than to high-achieving students' beliefs in mathematics.

For a number of years educators and psychologists have expressed concern about the deterioration of students' achievement-related attitudes, values, and performance after the transition to junior high school and have speculated about the reasons for these negative shifts (e.g., Berndt & Hawkins, 1987; Eccles, Midgley, & Adler, 1984; Finger & Silverman, 1966; Lipsitz, 1977, 1980; Mergendoller, 1982; Silberman, 1970; Simmons, Blyth, Van Cleave, & Bush, 1979; Sprinthall, 1985; Ward, Mergendoller, & Tikunoff, 1982). In an earlier cross-sectional study we found support for this trend: Children were more pessimistic about their ability and potential in mathematics and more negative about the value of mathematics from fifth to tenth grade with a sharp decline occurring after the transition to junior high school (Eccles et al., 1983; Eccles, Midgley, & Adler, 1984). Some investigators have suggested that this negative change is an inevitable age-related phenomenon associated with puberty and cognitive development. Although we believe that pubertal development may increase the vulnerability of early adolescents, we also believe that systematic changes in the classroom environment as children move from elementary to junior high school contribute to the decline in motivation and performance in math (Eccles & Midgley, in press; Eccles, Midgley, & Adler, 1984; Feldlaufer, Midgley, & Eccles, 1988).

Teachers are a very important part of the classroom environment. Teacher expectancies and beliefs have been shown to influence student motivation and achievement both directly through observable teacher behaviors and indirectly through more subtle forms of communication (Brophy & Good, 1974; Dunkin & Biddle, 1974; Dusek, 1985; Good, 1981; Heller & Parsons, 1981; Parsons, Kaczala, & Meece, 1982). Teacher beliefs about their personal effectiveness or efficacy have been the subject of several recent studies. Some researchers have suggested that teachers' efficacy beliefs influence students' motivation and achievement (e.g., Ashton & Webb, 1986; Brookover, Beady, Flood, Schweitzer, & Wisenbaker, 1979; Brophy & Evertson, 1977; Eccles & Wigfield, 1985; Murray & Staebler, 1974; Rutter, Maughan, Mortimore, Ouston, & Smith, 1979). Although the relation between teacher efficacy and student beliefs and attitudes is yet to be firmly established, Brookover et al. (1979), using schools as the unit of analysis, found negative correlations between teachers' sense of academic futility and students' self-concept of ability and self-reliance. A number of studies have found a positive relationship between teacher efficacy beliefs and student achievement (Armor et al., 1976; Ashton, Webb, & Doda, 1983; Berman, McLaughlin, Bass, Pauly, & Zellman, 1977; Brookover et al., 1979; Tracz & Gibson, 1987). Given these associations, differences in teachers' sense of efficacy before and after the transition to junior high school could contribute to the decline in some students' beliefs about their academic competency and potential.

Several characteristics of the junior high school make it probable that junior high school teachers' beliefs about their personal efficacy will be different than the beliefs of elementary school teachers. Junior high schools are typically larger and less personal than elementary schools. Because of departmentalization, junior high school teachers generally instruct many more students than do elementary teachers, making it less likely that they will come to know students well. Junior high school teachers may feel that it is difficult to affect the achievement of a large number of students, especially because they see each student for a relatively small proportion of the school day. In support of these suggestions, Fuller & Izu (1986) found that elementary teachers feel more efficacious than do secondary school teachers, and in a study by Guskey

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(1981), elementary school teachers accepted greater responsibility for their lack of success with students than did secondary teachers. Of particular importance, in a large longitudinal study the teachers students had for mathematics after the transition to junior high school felt significantly less efficacious than did the teachers these same students had for mathematics before the transition (Midgley, Feldlaufer, & Eccles, 1988).

Although these studies lend support to our beliefs about the effect of systematic changes in the classroom environment during the transition to junior high school, they do not provide a direct test of the impact of changing teacher efficacy beliefs on students' achievement-related attitudes in math. An adequate test of this hypothesis requires longitudinal data on both students and teachers across the transition to junior high school.

In most studies the relation between teacher efficacy and the dependent variables of interest is determined at one time point; essentially no studies have looked at the changing impact of teacher efficacy over time. Recently, researchers have emphasized the importance of considering the effect of time of year on the relationship between teacher beliefs and student outcomes (Brophy, 1983; Marshall & Weinstein, 1984). Because teacher efficacy is a belief system that may be communicated in subtle ways rather than a teacher behavior that is immediately apparent to students, it seems likely that there will be a lagged effect, with teacher efficacy having a stronger impact as the school year progresses. The lagged effect of low teacher efficacy may be especially marked during the first year of junior high school, with students experiencing a "honeymoon effect" as they enter a new school with feelings of excitement and anticipation (Bloom, 1978; Harter, Whitesell, & Kowalski, 1986). In addition, at the junior high school level students typically have a number of teachers each day; therefore it may take some time for the beliefs of one teacher, such as a mathematics teacher, to have an effect on students' beliefs and attitudes in that subject area. Therefore, it is preferable to gather data at more than one time point within each school year, as well as across the two years marking the transition to junior high school.

Furthermore, student achievement level may be an important moderator of the impact of teachers' sense of efficacy. Whether or not they have teachers who feel efficacious, high-achieving students may continue to feel positively about their ability and potential because their performance will still be adequate. In contrast, teachers' sense of efficacy should have a more powerful impact on low-achieving students for two reasons: First, because low-achieving students feel less positively about their academic competency and are less certain of their future success than are high-achieving students, these students may be more extrinsically motivated (Harter & Connell, 1984) and thus more vulnerable to differences in their teachers' beliefs. Second, as Eccles and Wigfield (1985) have hypothesized, teachers who do not feel efficacious may be especially likely to communicate low expectations to low-achieving students, thus increasing the likelihood of "Golem" teacher expectancy effects (Babad, Inbar, & Rosenthal, 1982). In support of this suggestion, in the Brookover et al. study (1979) academic achievement was higher in high socioeconomic status (SES) schools than in low SES schools, and teachers' sense of academic futility was more highly correlated with achievement in low SES schools ($r = -.21$) than in high SES schools ($r = -.03$). In addition, the correlation between teacher sense of academic futility and mean student self-concept of ability was .07 in high SES schools and .37 in low SES schools.

In this study, we make the following hypotheses:

1. Students who have teachers with a higher sense of efficacy in either the last year of elementary school or the first year of junior high school will have more positive self- and task-related beliefs in mathematics by the end of that school year than will students who have teachers with a lower sense of efficacy;
2. Changes in students' self- and task related beliefs in mathematics within each school year will be related to the efficacy beliefs of their teacher for that year;
3. Changes in students' self- and task-related beliefs in mathematics before and after the transition to junior high school will be related to differences in their pre- and posttransition teachers' sense of efficacy;
4. The relationship between changes in students' beliefs before and after the transition to junior high school and differences in their pre- and posttransition teachers' sense of efficacy will be stronger for low-achieving students than for higher achieving students.

Method

The data reported here were collected as part of a two-year, four-wave panel study (*The Transitions at Early Adolescence Project*) investigating the impact of changes in classroom and family environments on early adolescents' motives, beliefs, values, and behaviors. Analyses reported here include data collected at all four waves of the study (fall and spring of the 1983–1984 school year and fall and spring of the 1984–1985 school year).

Sample

Twelve school districts located in middle-income communities in southeastern Michigan, all within a 50-mile radius of Detroit, were recruited for this project. All teachers in these districts who taught mathematics to fifth- or sixth-graders scheduled to make a transition the next year to middle or junior high school were recruited the first year: 95% of the teachers, representing 143 classrooms, agreed to participate. Students were followed the second year into 171 mathematics classrooms. All eligible Year 2 teachers agreed to participate. Of the eligible students, 79% agreed to participate. A student attrition rate of 14% between Years 1 and 2 was accounted for largely by students who moved out of participating school districts. A total of 2,501 students filled out questionnaires at all four waves of the project.

Case Selection

A subset of the teacher and student sample from the *Transitions Project* was used in the analyses reported here. One school district was excluded from this study because policy changed during the course of data collection so that students did not move to a new school. Students who moved from fifth to sixth grade were also excluded from the study. The student sample in this study consists of 1,329 students who made a transition from a sixth-grade elementary school classroom to a seventh-grade junior high school classroom,

had the same teacher for math both semesters each year, and completed the Michigan Educational Assessment Test (MEAP) in the seventh grade. Of the 1,329 students, 52% were female and 96% were white. The teacher sample includes the teachers those students had for mathematics before and after the transition to junior high school: 95 pretransition teachers and 46 posttransition teachers. There are fewer post- than pretransition teachers because each junior high school teacher instructs several sections of math.

Measures

Teacher efficacy. A teacher questionnaire assessing a wide range of beliefs, including teachers' trust and respect for students, beliefs about the need to control and discipline students, feelings of personal teaching efficacy, and views of ability as a modifiable intellectual skill or a stable trait, was given to pretransition teachers in the fall of 1983 and posttransition teachers in the fall of 1984. Teachers were asked to return their completed questionnaires in a mailer provided by the researchers. One pretransition teacher and 4 posttransition teachers failed to return a teacher questionnaire.

In order to show empirical support for the differentiation of the constructs of interest, a principal components analysis was undertaken. On the basis of Cattell's (1966) scree test of the characteristic roots, a common factor analysis was performed and four factors were extracted. Orthogonal and oblique rotations were used to interpret the pattern of loadings and in both cases the factors were theoretically distinct and represented the constructs under investigation. A five-item factor was identified that measures teachers' sense of personal teaching efficacy. Each of these items contains the pronoun *I* and asks teachers about their views of their own efficacy as teachers. Another factor emerged that measures teachers' beliefs about general teaching efficacy, or the belief that student learning can be modified by effective teachers. Recent research on teacher efficacy confirms the distinction between general and personal teaching efficacy, indicating that they are separable views with different determinants and consequences (Ashton, Olejnik, Crocker, & McAuliffe, 1982; Gibson & Dembo, 1984; Guskey, 1981, 1982, 1986; Rose & Medway, 1981; Selove, 1984). Factors measuring teacher trust of students, and beliefs about the need to control and discipline students, also were identified. In this study we were interested in examining teachers' views of their personal teaching efficacy.

A scale measuring personal teaching efficacy was constructed by summing the item scores. This scale contains the item used by the Rand Corporation to measure personal teaching efficacy (Armor et al., 1976; Berman et al., 1977), two items developed and used by Brookover et al. (1979), one item developed by Webb (Ashton et al., 1982), and one original item (Midgley et al., 1988). Table 1 summarizes the wording of items and gives the Cronbach's coefficient of alpha for the personal efficacy scale ($\alpha = .65$). In order to compare the personal efficacy beliefs of pre- and posttransition teachers, the same scale must be used with each group. For this reason, the factor analysis was conducted with item scores for the entire teacher sample. If the items had been factored separately for elementary and junior high school teachers, the factors and resulting scales would have differed somewhat for the two samples, and the alpha coefficient probably would have been higher. In an earlier study comparing the belief systems of pre- and posttransition teachers (Midgley et al., 1988) we found that correlations among the items differed somewhat for the two groups of teachers. In order to use the same scale for both samples, some error is introduced.

Student self- and task-related beliefs in mathematics. Questionnaires measuring students' beliefs, values, and behaviors across multiple activity domains were administered by field staff to students during the period they normally received mathematics instruction for two consecutive days in the fall and spring of the sixth-grade and seventh-grade school years. Scales used in this study were limited to the mathematics domain because measures of teacher efficacy were collected from math teachers only.

The dependent variables selected for this study were scales measuring students' expectancies for success in math, perceptions of their performance in math, and perceptions of the difficulty of math. These items were originally developed by Parsons (1980). Table 1 summarizes the wording of items in each of these scales. Extensive exploratory and confirmatory factor analyses of students' responses to these items support the discriminant validity of these scales (see Eccles, Adler, & Meece, 1984; Reuman, 1986). Scales were created by taking the mean of the items defining each composite, using unit weighting for each item. Cronbach's alpha reliability coefficients were computed for each composite and are moderately high (see Table 1).

Student achievement in mathematics. During the fall of 1984, all seventh-grade students completed the Michigan Educational Assessment Program (MEAP) as part of a statewide testing program in reading and mathematics. This test consists of sets of items measuring selected minimum performance objectives. In mathematics, each of 28 objectives is measured by a set of three items. The objective is attained if at least two of the three items are answered correctly. In addition to a raw score based on the number of objectives obtained, a "category of achievement" ranking from one to four is given on each test. We grouped the students in this study into one of two achievement "categories—high or low—based on their category of achievement on the MEAP. Approximately 75% of the sample (530 girls and 468 boys) fell into categories two, three, and four. These students attained three fourths or more of the math objectives (22–

Table 1
Measures of Teacher Efficacy and Student Self- and Task-Related Beliefs in Mathematics

Teacher measure
Teacher efficacy ($\alpha = .65$)
If I try really hard I can get through to even the most difficult or unmotivated student.
If some students in my class are not doing well in math, I feel that I should change my approach to the subject.
By trying a different teaching method, I can significantly affect a student's achievement.
There is really very little I can do to insure that most of my students achieve at a high level.
I am certain I am making a difference in the lives of my students.
(1) Strongly disagree–(5) Strongly agree
Student measures
Expectancies in math ($\alpha = .78$)
How well do you think you will do in math this year?
(1) Not at all well–(7) Very well
How successful do you think you'd be in a career that required mathematical ability?
(1) Not very successful–(7) Very successful
Perceived performance in math ($\alpha = .73$)
When taking a math test I have studied for, I do
How have you been doing in math this year?
(1) Very poorly–(7) Very well
Perceived task difficulty in math ($\alpha = .72$)
In general, how hard is math for you?
(1) Very easy–(7) Very hard
Compared to most other school subjects you have taken or are taking, how hard is math for you?
(1) My easiest course–(7) My hardest course

Note. Factor analytic procedures and reliability assessment were conducted with a larger sample of teachers and students. Alpha coefficients reported in this table for the student scales are averages of coefficients obtained at each of the four waves.

28 objectives) and are considered "high" achieving students in this study. Category one is the lowest ranking and is given to students who attained less than three fourths of the math objectives (0–21). These students (167 girls and 164 boys) are categorized as "low" achievers in this study. Because this test assesses only minimal performance objectives and does not discriminate well among those achieving at the high end, we felt a 75%/25% split based on the MEAP category of achievement would allow us to identify the truly low achievers whom we believed would be most affected by their teachers' sense of efficacy.

Analysis Overview

Hypotheses were tested using a four-step analysis plan. First, simple regression was used to determine whether students of teachers who viewed themselves as more efficacious had higher expectancies and perceptions of their performance in math and lower perceptions of the difficulty of math in the spring semester of each school year than did students of teachers who viewed themselves as less efficacious (Hypothesis 1).

Second, multiple regression was used to determine whether students' self- and task-related beliefs in mathematics were related to their teachers' sense of efficacy in the spring of each year, controlling for students' beliefs at the beginning of each year (Hypothesis 2).

Third, to test the relationship between teacher sense of efficacy and changes in student beliefs within and across the school years and the interaction with student level of achievement, we constructed a categorical version of the teacher efficacy measure. Students were divided into four groups based on their teachers' sense of efficacy before and after the transition (students who moved from a teacher with a low sense of teaching efficacy Year 1 to a teacher with a low sense of teaching efficacy Year 2, students who moved from a teacher low in sense of efficacy to one high in sense of efficacy, those who moved from a high-efficacy teacher to a low-efficacy teacher, and those who had a high-efficacy teacher both years). To create this variable, scores from 11 to 19 on the continuous version of the efficacy measure each year were categorized as "low" and scores from 20 to 25 were categorized as "high." Using these criteria, in Year 1, 591 students had "low efficacy" teachers and 738 students had "high efficacy" teachers. In the second year, 1,033 students had "low efficacy" teachers and 296 students had "high efficacy" teachers. The differences in the cells reflect the fact that the same criterion was used to categorize teacher efficacy both years, and Year 1 teachers had a significantly higher sense of personal teaching efficacy than did Year 2 teachers. For further elaboration of these elementary versus junior high school differences in teacher efficacy, see Midgley et al. (1988). On the resulting efficacy change variable, 474 students had a low-efficacy teacher in both years, 117 moved from a low-efficacy teacher in Year 1 to a high-efficacy teacher in Year 2, 559 had a high-efficacy teacher in Year 1 and a low-efficacy teacher in Year 2, and 179 had a high-efficacy teacher in both years. Repeated measures multivariate analysis of variance (MANOVA) was used to test the effects of semester (fall vs. spring), school year (sixth vs. seventh grade), and the interaction of semester and school year for each of the dependent measures. In analyses assessing semester effects, Waves 1 and 3 were compared to Waves 2 and 4; year effects were based on comparisons of Waves 1 and 2 to Waves 3 and 4; and the interaction of semester and year compared the rate of change in Year 1 with the rate of change in Year 2. Student expectancies for success in math, perceived performance in math, and perceived task difficulty in math were the dependent variables. Teacher efficacy change from Year 1 to Year 2 (low Year 1 to low Year 2, low to high, high to low, and high to high), student gender, and student achievement (low or high category of achievement based on the MEAP) were included as between-subjects factors. These analyses were used to test Hypotheses 2, 3, and 4.

Table 2
The Relation Between Teacher Efficacy and Student Self- and Task-Related Beliefs in Mathematics

Wave	Expectancies	Perceived performance	Perceived task difficulty
1 (Fall 1983)			
F	1.61	0.74	0.91
β	0.03	−0.02	0.03
2 (Spring 1984)			
F	5.75*	5.81*	1.96
β	0.07	0.07	−0.04
3 (Fall 1984)			
F	4.00	0.79	0.07
β	0.05	0.02	−0.01
4 (Spring 1985)			
F	11.89***	8.82**	14.04***
β	0.09	0.08	−0.10

Note. βs are standardized regression coefficients. $N = 1{,}329$.
* $p < .02$. ** $p < .01$. *** $p < .001$.

Table 3
The Relation Between Teacher Efficacy and Within-Year Changes in Students' Self- and Task-Related Beliefs in Mathematics

Year	Expectancies	Perceived performance	Perceived task difficulty
1 (1983–1984)			
t	2.05	3.55**	−2.37
β	0.04	0.08	−0.05
2 (1984–1985)			
t	2.81*	3.04*	−4.25**
β	0.06	0.07	−0.10

Note. βs are standardized regression coefficients. $N = 1{,}329$.
* $p < .01$. ** $p < .001$.

Fourth, the fact that the omnibus F test in the MANOVA is significant indicates nothing about which efficacy groups differ significantly from which other efficacy groups. Therefore, post hoc comparisons using the Scheffé method were conducted to compare each of the teacher efficacy groups to each of the other groups to determine if they differed significantly from each other in regard to average semester, year, and semester by year changes on the dependent variables. As was true with the MANOVA, semester effects were determined by pooling Waves 1 and 3 and subtracting from Waves 2 and 4; year effects compared the combined means at Waves 1 and 2 to those at Waves 3 and 4; and Year × Semester effects compared Waves 1 and 4 to Waves 2 and 3. Because the alpha coefficient reflects the error rate for the entire set of contrasts, this technique provides a conservative estimate of effects.

Results

Hypothesis 1

To test the first hypothesis, simple regression was used to determine the association between teacher efficacy, using the continuous version of the variable, and student self- and task-related beliefs in mathematics in the spring of each year. As shown in Table 2, there was a significant relation between teacher efficacy and student expectancies and perceived performance in math in the spring of the last year of elementary

school, and an even stronger relation between teacher efficacy and all three dependent variables in the spring of the first year of junior high school. In the spring of both years, students who had teachers with a more positive sense of teaching efficacy believed that they were performing better in math and expected to do better in the future than did students whose teachers had less positive efficacy beliefs. In addition, in the spring of the first year of junior high school, students who had higher efficacy teachers believed math was less difficult than did students who had lower efficacy teachers.

Hypothesis 2

The second hypothesis was tested using both the continuous and categorical versions of the efficacy measure. First, multiple regression was used to assess the association between the continuous version of the teacher efficacy measure and the dependent variables in the spring of each school year, controlling for the values at the beginning of each school year. As shown in Table 3, in the first year of junior high school (Year 2 of the study), within-year changes in the dependent variables were related to teacher sense of efficacy. Students whose teachers felt less efficacious lowered their expectancies and perceptions of their performance and raised their perceptions of the difficulty of math during the school year more than did students whose teachers felt more efficacious. In the elementary school year, this was true only for student perceptions of their performance.

Second, looking at the semester changes across both school years and using the categorical version of the efficacy measure, the hypothesis that changes in students' self- and task-related beliefs in mathematics within the school year would be related to their teachers' sense of personal efficacy was tested using the Semester × Efficacy Change interaction term from a repeated measures multivariate analysis of variance. As shown in Table 4, there was a significant association between efficacy group and within-year changes on each of the dependent variables. Inspection of Table 5, which gives the means and

Table 4
Effects of Teacher Efficacy, Student Sex, Student Achievement, Semester, and School Year on Students' Self- and Task-Related Beliefs in Mathematics

Effects	*df*	Dependent variables: Expectancies	Perceived performance	Perceived task difficulty
Between-subjects				
Sex	1	1.99	0.22	5.20
Efficacy Change	3	10.03***	4.53*	2.09
Achievement	1	124.99***	191.95***	99.58***
Sex × Efficacy Change	3	0.10	0.40	1.07
Sex × Achievement	1	2.43	0.59	0.07
Efficacy Change × Achievement	3	1.98	1.98	1.46
Sex × Efficacy Change × Achievement	3	0.38	0.70	1.08
Within-subjects				
Year	1	18.24***	30.55***	1.44
Year × Sex	1	0.22	0.04	0.34
Year × Efficacy Change	3	1.73	1.14	0.58
Year × Achievement	1	2.77	0.10	14.85***
Year × Sex × Efficacy Change	3	0.88	2.39	0.94
Year × Sex × Achievement	1	0.26	0.41	1.12
Year × Efficacy Change × Achievement	3	6.34***	7.70***	1.94
Year × Sex × Efficacy Change × Achievement	3	1.99	1.73	1.99
Semester	1	56.51***	22.30***	0.36
Semester × Sex	1	0.40	0.85	1.70
Semester × Efficacy Change	3	5.69**	7.76***	5.30**
Semester × Achievement	1	3.82	1.92	0.05
Semester × Sex × Efficacy Change	3	2.80	2.29	1.11
Semester × Sex × Achievement	1	0.23	1.08	1.86
Semester × Efficacy Change × Achievement	3	2.97	2.62	1.60
Semester × Sex × Efficacy Change × Achievement	3	3.95*	1.60	0.28
Year × Semester	1	8.10*	12.10**	0.12
Year × Semester × Sex	1	0.68	0.69	0.02
Year × Semester × Efficacy Change	3	9.39***	13.31***	4.25*
Year × Semester × Achievement	1	0.71	1.97	2.05
Year × Semester × Sex × Efficacy Change	3	1.88	2.10	3.52
Year × Semester × Sex × Achievement	1	1.88	0.75	3.13
Year × Semester × Efficacy Change × Achievement	3	6.52***	2.33	2.92
Year × Semester × Sex × Efficacy Change × Achievement	3	0.82	2.13	3.07

Note. $N = 1{,}329$. Cells display F tests based on repeated measures multivariate analyses of variance.
$^{*}p \leq .01$. $^{**}p \leq .001$. $^{***}p \leq .0001$.

Table 5
Means and Standard Deviations of Self- and Task-Related Beliefs in Mathematics for All Students and for High- and Low-Achieving Students Separately

		Expectancies				Perceived performance				Perceived task difficulty			
Efficacy	*n*	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
All students													
Low/Low	474												
M		5.59	5.43	5.48	5.23	5.80	5.62	5.60	5.48	3.19	3.27	3.26	3.33
SD		1.15	1.28	1.23	1.37	1.11	1.23	1.28	1.32	1.34	1.32	1.24	1.37
Low/High	117												
M		5.77	5.45	5.60	5.44	5.85	5.63	5.58	5.46	3.04	3.13	3.29	3.15
SD		1.17	1.41	1.08	1.20	1.07	1.33	1.13	1.26	1.37	1.52	1.43	1.39
High/Low	559												
M		5.58	5.50	5.53	5.12	5.69	5.69	5.67	5.22	3.26	3.17	3.32	3.53
SD		1.17	1.17	1.10	1.40	1.14	1.14	1.16	1.46	1.38	1.31	1.23	1.41
High/High	179												
M		5.85	5.90	5.71	5.55	5.73	5.97	5.72	5.58	3.16	2.98	3.24	3.05
SD		1.06	1.00	1.14	1.21	1.11	1.01	1.20	1.31	1.35	1.34	1.39	1.32
All	1329												
M		5.64	5.52	5.54	5.24	5.75	5.70	5.64	5.38	3.20	3.18	3.29	3.36
SD		1.15	1.22	1.15	1.36	1.12	1.18	1.21	1.38	1.36	1.34	1.27	1.39
High-achieving students													
Low/Low	358												
M		5.76	5.62	5.70	5.51	5.97	5.81	5.90	5.78	3.02	3.10	3.14	3.13
SD		0.99	1.13	1.05	1.15	0.95	1.07	1.02	1.07	1.28	1.25	1.20	1.29
Low/High	75												
M		6.12	5.95	5.79	5.66	6.25	6.16	5.81	5.79	2.62	2.67	2.97	3.00
SD		0.87	0.97	1.01	1.06	0.77	0.79	1.05	1.08	1.26	1.38	1.38	1.38
High/Low	434												
M		5.76	5.65	5.63	5.36	5.89	5.87	5.84	5.49	3.11	3.01	3.25	3.43
SD		0.98	1.04	1.04	1.27	0.96	1.00	1.04	1.30	1.31	1.24	1.24	1.42
High/High	131												
M		6.02	6.04	5.84	5.61	5.98	6.11	5.85	5.71	2.92	2.73	3.07	2.96
SD		0.97	0.93	1.07	1.18	0.97	0.92	1.15	1.24	1.35	1.25	1.36	1.32
All	998												
M		5.82	5.71	5.70	5.47	5.96	5.90	5.86	5.65	3.02	2.98	3.17	3.23
SD		0.98	1.06	1.05	1.20	0.95	1.01	1.04	1.21	1.32	1.26	1.25	1.37
Low-achieving students													
Low/Low	116												
M		5.09	4.82	4.81	4.36	5.28	5.01	4.68	4.54	3.72	3.78	3.64	3.94
SD		1.44	1.53	1.47	1.61	1.39	1.49	1.54	1.55	1.38	1.42	1.29	1.41
Low/High	42												
M		5.13	4.56	5.25	5.06	5.14	4.69	5.15	4.87	3.79	3.94	3.87	3.42
SD		1.38	1.63	1.13	1.36	1.16	1.57	1.16	1.36	1.24	1.41	1.36	1.41
High/Low	125												
M		4.94	4.98	5.18	4.26	5.02	5.06	5.06	4.30	3.76	3.74	3.56	3.85
SD		1.51	1.44	1.23	1.50	1.41	1.35	1.35	1.60	1.37	1.37	1.18	1.36
High/High	48												
M		5.41	5.53	5.35	5.36	5.06	5.58	5.38	5.23	3.80	3.69	3.70	3.28
SD		1.19	1.10	1.26	1.28	1.20	1.13	1.29	1.42	1.25	1.32	1.39	1.31
All	331												
M		5.09	4.95	5.08	4.56	5.13	5.07	4.98	4.59	3.76	3.77	3.65	3.75
SD		1.42	1.47	1.32	1.54	1.35	1.41	1.41	1.56	1.34	1.38	1.27	1.39

Note. W1 = Wave 1, W2 = Wave 2, W3 = Wave 3, W4 = Wave 4.

standard deviations for each scale at each wave, and Figures 1 through 3 reveals the nature of these changes for each of the dependent variables.

Post hoc comparisons using the Scheffé method aid in interpreting which efficacy change groups differ significantly from which other groups in terms of within-year changes in the dependent variables. Using a .95 confidence interval, we found that students who moved from a high-efficacy teacher in elementary school to a low-efficacy teacher in junior high school had significantly different average within-year changes in expectancies, perceived performance, and perceived task difficulty than did students who had a high-efficacy teacher both years. Students who moved from high- to low-efficacy teachers experienced less positive within-year changes in expectancies, perceived performance, and perceived task difficulty than did students who had high-efficacy teachers both years. In the case of perceived performance and task difficulty, students who had a high-efficacy teacher both years also

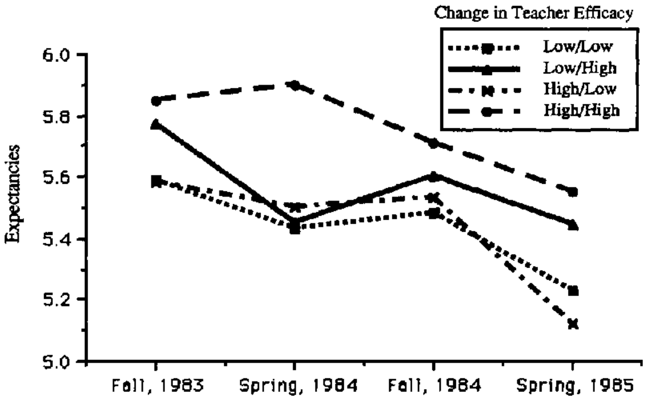

Figure 1. Perceived expectancies in math and change in teacher efficacy.

experienced different changes within the year than did students who had a low-efficacy teacher both years. The nature of these interactions differs slightly for the two dependent variables and the effect for perceived performance is superseded by the significant year by semester by efficacy change group interaction described below. A fairly simple pattern emerges for perceived task difficulty. As one would expect, students with high-efficacy teachers both years believed that math became less difficult as each year progressed, whereas students who had low-efficacy teachers both years saw math as more difficult at the end than at the beginning of the school years.

Hypothesis 3

Support for the third hypothesis, that changes in students' self- and task-related beliefs in mathematics before and after the transition from elementary school to junior high school will be related to differences in their pre- and post-transition teachers' sense of personal teaching efficacy is provided by the year by semester by efficacy change interactions for each of the dependent variables (see Table 4). The rate of change within the school year in expectancies, perceived performance, and perceived task difficulty is different at Year 1 and Year 2 depending on teacher efficacy before and after the transition. An examination of the means at each wave (see Table 5) indicates that on each dependent variable the largest differences between the Year 1 semester changes and the Year 2 semester changes are for the group of students who move from high-efficacy teachers in sixth grade to low-efficacy teachers in seventh grade. Post hoc comparisons using the Scheffé method suggest three types of relevant year by semester by efficacy change effects: a significant difference between students in the High/Low and Low/High efficacy change groups for expectancies, perceived performance, and perceived task difficulty, and a significant difference between students in the Low/Low and High/Low, and Low/Low and High/High groups in perceived performance. Inspection of Table 5 and Figures 1, 2, and 3 reveals the nature of each of these comparisons. Comparisons involving the High/Low versus Low/High groups provide the clearest support for Hypothesis 3. For each of the three dependent measures the group that changes in the most negative direction (decline in expectancies and perceived performance and increase in perceived task difficulty) is the group that went from a high-efficacy teacher in sixth grade to a low-efficacy teacher in seventh grade. The shift is especially marked when one compares the pattern across the four waves for this High/Low group with the pattern for the Low/High group, who showed the most negative changes during the sixth grade in expectancies and perceived performance and relatively little negative change during the seventh grade.

The significant High/Low versus Low/Low comparison for perceived performance provides additional support for the third hypothesis. As can be seen in Figure 1, the High/Low group, who experienced a negative change in their teachers' sense of efficacy when they moved to junior high school, showed a more marked decline that year than did the Low/Low group, who experienced no change in their teachers' sense of efficacy.

Hypothesis 4

Support for the hypothesis that the changes identified in Hypothesis 3 would be more marked for low-achieving students in math than for higher-achieving students in math is provided by the significant Year × Efficacy Change × Student Achievement interaction for expectancies and perceived performance and by the significant Year × Semester × Efficacy Change × Student Achievement interaction term for expectancies (see Table 4). Inspection of Table 5 and Figures 4–7 reveals the nature of these interactions. Figures 4 and 6 show that for higher-achieving students, the changes in students' expectancies and perceived performance across the two years of the study seem to be related only moderately to their teachers' sense of efficacy before and after the transition. For higher-achieving students, the pattern of change for the four efficacy groups looks somewhat similar. In fact, student expectancies and perceptions of their performance *declined* the most after the transition for the two groups of high-achieving

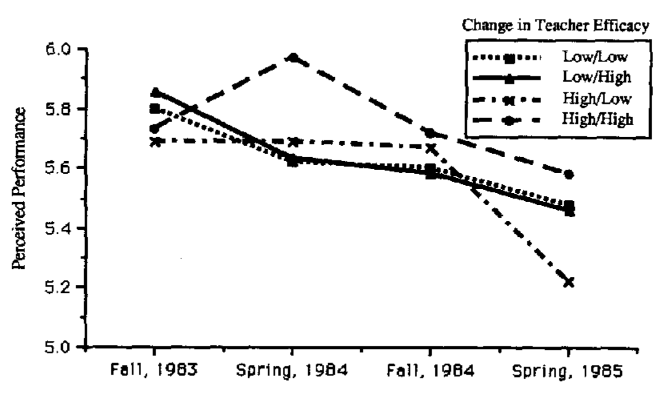

Figure 2. Perceived performance in math and change in teacher efficacy.

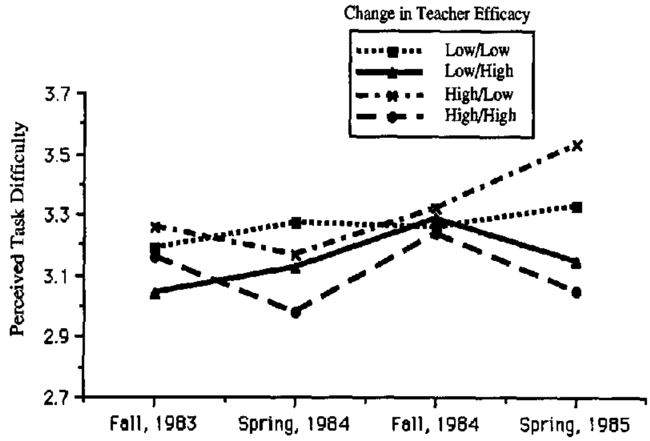

Figure 3. Perceived task difficulty in math and change in teacher efficacy.

students who had *high* efficacy teachers Year 2. In contrast, Figures 5 and 7 show that changes in the beliefs of low-achieving students across the two years were strongly related to the efficacy beliefs of their pre- and posttransition teachers. The one group of low-achieving students that had higher expectancies and perceived performance Year 2 than Year 1 is the group that moved from low- to high-efficacy teachers after the transition to junior high school. The two groups of low-achieving students that experienced the biggest drop in expectancies and perceived performance in the seventh grade were students who had low-efficacy teachers both years or who moved from high- to low-efficacy teachers.

The interaction of student category of achievement with the year by semester by efficacy change effect on student expectancies can be seen in Figures 5 and 7. For low-achieving students, the most dramatic difference between semester changes at Year 1 and Year 2 in expectancies were the slight increase in Year 1 and the sharp decrease in Year 2 for students who moved from high- to low-efficacy teachers. This compares to students who moved from low- to high-efficacy teachers, who experienced a sharper decline in Year 1 than in Year 2. For higher achieving students, changes in expectancies within Year 1 and Year 2 were somewhat similar for the various efficacy change groups. The only group where there were obvious differences in the rate of change at Year 1 and Year 2 is the group that had high-efficacy teachers both years.

There was no interaction of student level of achievement with year or with year by semester effects of teacher efficacy on student perceptions of the difficulty of math.

Discussion

Teachers' beliefs about their efficacy have piqued the interest of researchers and educators because of the relationship of these beliefs to student achievement. Few teacher beliefs have shown this relationship. We now know that there is also a consistent relationship between teachers' beliefs about their personal efficacy and students' beliefs about their performance and potential in mathematics and the difficulty of the subject matter.

As predicted, in the spring of both years students with more efficacious teachers had higher expectancies and perceptions of their performance in math than did students with less efficacious teachers. In addition, in the spring of their seventh grade year, students with more efficacious teachers rated math as less difficult than did students with less efficacious teachers. Why this effect is somewhat stronger in the spring of junior high school than in the spring of the last year of elementary school is an interesting question. There could be more measurement error in the data collected at the elementary school level. Even though we asked elementary teachers to focus on the mathematics domain, most of them teach their students other subjects as well. Their answers to the efficacy measure could be based on their feelings about their effectiveness beyond the mathematics domain and therefore not have as strong a relationship to student beliefs in mathematics as do the efficacy beliefs of junior high school math teachers. Alternatively, the children are a year older and may be more sensitive to adult beliefs, or there could be something about the junior high school environment that makes teacher sense of efficacy particularly influential.

There is also support for the hypothesis that changes in students' beliefs within the school year are related to their teachers' sense of efficacy. First, looking at each school year separately, changes within the junior high school year on all three dependent variables were related in predictable ways to teacher efficacy. However, in the last year of elementary school this was true only for student perceptions of their performance. Second, semester changes in the dependent variables across both school years (Semesters 1 and 3 vs. Semesters 2 and 4) were related to teacher efficacy before and after the transition. Generally, the beliefs of students who had low-efficacy teachers became more negative as the school years progressed, whereas the beliefs of students who had high-efficacy teachers became more positive or showed less negative change from the beginning to the end of the school years.

The fact that there were no significant year by efficacy change effects on the dependent variables is directly related to the time of year the measures were given. In the fall of the year (Waves 1 and 3) student beliefs were unrelated to their teachers' sense of efficacy. Thus averaging across the two

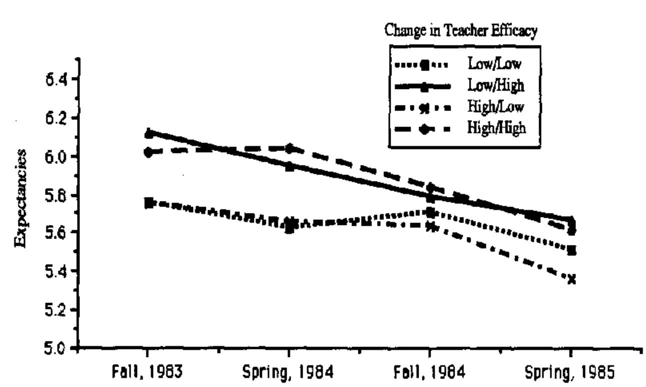

Figure 4. Perceived expectancies in math and change in teacher efficacy for high-achieving students.

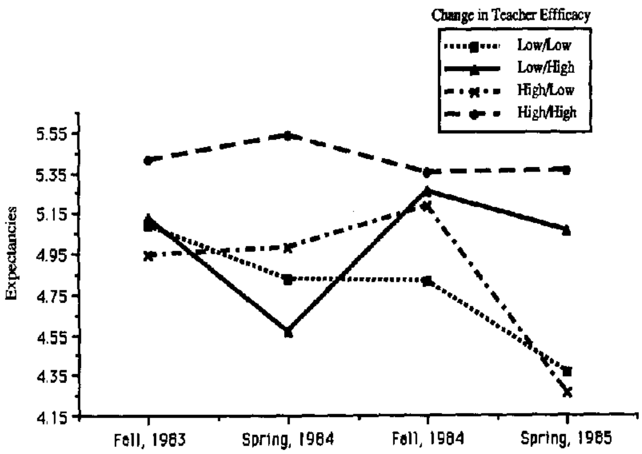

Figure 5. Perceived expectancies in math and change in teacher efficacy for low-achieving students.

semesters, as is done to calculate year effects, weakens the impact of the relationships that are apparent by the second semester each year. Teacher efficacy does not have an immediate impact on students as might be the case with more easily observed teacher beliefs and behaviors such as trust, friendliness, fairness, or ability grouping practices. Students moving to a new classroom may be immediately aware that they have been assigned to a low-ability or high-ability math class or may be quickly affected by the warmth or fairness of their teachers. However, teacher sense of efficacy is evidently a somewhat subtle belief that is manifested in ways that are not immediately apparent to students. This finding points to the importance of taking time of year into consideration in studies of the effects of teacher efficacy. If only one measurement point during the year is planned, this study would point to waiting until the second semester. But this study substantiates the advantages of having multiple measurement points both within and across the school years.

The fact that teacher efficacy does not have an immediate impact highlights the importance of the significant year by semester effects in assessing the possible causal impact of teacher efficacy across the transition. What becomes critical is the fact that the differences in the rate of change in student beliefs each year depend on teacher sense of efficacy before and after the transition. Thus the group of students who move from high- to low-efficacy teachers has very different patterns across the two years than does the group of students who move from low- to high-efficacy teachers. It is important to consider these findings in light of the evidence that posttransition teachers feel less efficacious than do pre-transition teachers so that most students are experiencing this debilitating pattern. In an earlier study in mathematics classrooms we found that seventh-grade junior high school teachers felt significantly less efficacious than sixth-grade elementary school teachers and that 15% of the variance on the efficacy scale was accounted for by school level (Midgley et al., 1988). In the current study the largest group of students moved from high- to low-efficacy teachers after the transition (see Table 5). It is illuminating to look at this group of High/Low students in Figures 1, 2, and 3. These students suffer the most in terms of attitudinal change in the junior high school, and end up with the lowest expectancies and perceived performance, and highest perceptions of task difficulty by the spring semester, even lower than students who have low-efficacy teachers both years. It will be important to try to determine the basis for these differences in the beliefs of pre- and posttransition teachers so that changes can be made that will enable junior high teachers to develop more positive and facilitative beliefs about their effectiveness.

As is true for teacher expectancies for individual students, the question of how these teacher beliefs are communicated is an important one. Teachers' sense of efficacy may influence both their motivational and instructional strategies. In one of the Ashton and Webb studies (1986) high teacher sense of efficacy was significantly related to the maintenance of a warm, accepting classroom climate. Gibson and Dembo (1984) conducted observations in elementary classrooms and found differences between high- and low-efficacy teachers in time spent in whole class versus small group instruction, use of criticism, and persistence in failure situations. It is possible, of course, that teachers who believe they are efficacious are actually more effective. To the extent that this is true, the changes in students' perceptions could reflect not only the effect of their teachers' efficacy beliefs, but also their teachers' skills in helping them learn the subject matter. More work needs to be done to identify the mechanisms by which teachers' views of their efficacy influence changes in students' beliefs.

We found that teacher efficacy beliefs had a stronger relationship to changes in low-achieving students' self- and task perceptions in math than to changes in higher-achieving students' perceptions. As shown in Figures 4 and 6, higher-achieving students seem rather impervious to their teachers' sense of efficacy. The pattern of change across the two years for high-achieving students in the four teacher efficacy groups looks somewhat similar, particularly in the case of the relation to student expectancies. In contrast, as shown in Figures 5 and 7, the pattern of change in expectancies and perceived performance for low-achieving students is related quite dramatically to the efficacy beliefs of their teachers. For example, in Figure 5 the two groups of low-achieving students who

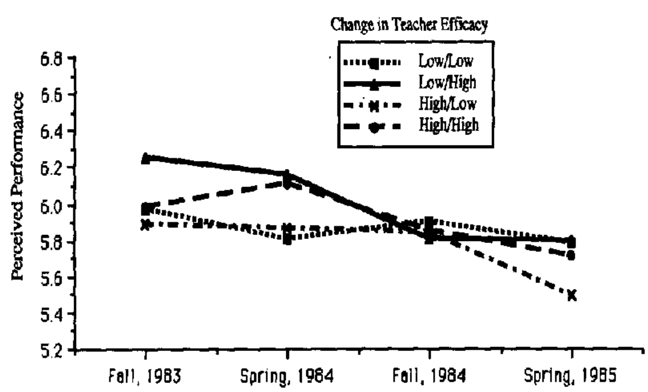

Figure 6. Perceived performance in math and change in teacher efficacy for high-achieving students.

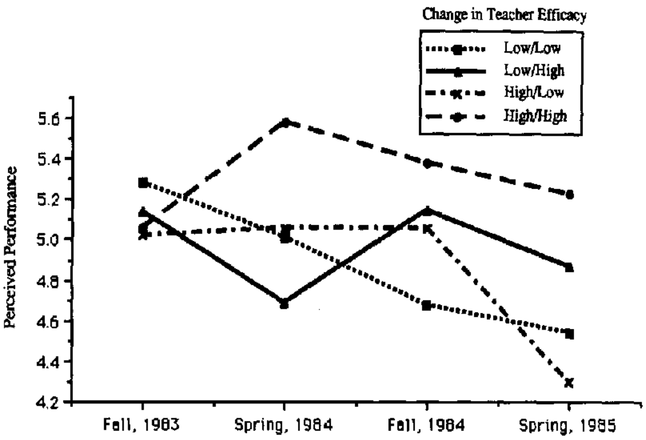

Figure 7. Perceived performance in math and change in teacher efficacy for low-achieving students.

have high-efficacy teachers the first year (High/High and High/Low) raise their expectancies from the beginning to the end of the elementary year and two groups of students who have low-efficacy teachers the first year (Low/Low and Low/High) lower their expectancies by the end of the year. Similarly, the two groups of students who have high-efficacy teachers the second year (High/High and Low/High) experience relatively little change in their math expectancies whereas those who have low-efficacy teachers (Low/Low and High/Low) show a dramatic decline. Again, the effect on these low-achieving students who move from high- to low-efficacy teachers at the transition to junior high is particularly important because there is evidence cited above that this is the most common pattern.

The fact that teacher efficacy beliefs have a stronger impact on low-achieving than on high-achieving students is especially provocative given the tendency to assign teachers with a less positive sense of efficacy to groups of low-achieving students (Ashton & Webb, 1986; Hargreaves, 1967; Webb, 1982). These data indicate that the opposite would make more sense—that it would be particularly important to assign teachers with a high sense of efficacy to classes of low-achieving students because higher-achieving students appear more impervious to both the positive and negative effects of teacher efficacy beliefs. In this study we found no evidence that low-efficacy teachers were assigned to teach low-achieving students. In those junior high schools that assigned students to math classrooms on the basis of their ability, teachers taught several different ability levels. Our findings point to the importance of describing the characteristics of the student sample in studies of teacher efficacy effects, particularly the students' achievement level. Obviously the impact of teacher efficacy on student beliefs would have been much more dramatic in this study if we had limited the sample to students in remedial classrooms, as was the case with one of the major studies conducted by Ashton and Webb (1986). It should also be noted that average student ability level in a classroom may influence teacher sense of efficacy. In future studies it would be interesting to measure teacher efficacy beliefs in both the fall and spring in order to see if changes in teacher efficacy beliefs are related to characteristics of the students they teach.

Why is it that teachers' views of their efficacy have a stronger relationship to the attitudes of low-achieving than high-achieving students? We suggested in the introduction that low-achieving students may have a more external locus of control and therefore may be more responsive to their teachers' efficacy beliefs. In future studies, assessing student locus of control might contribute to a better understanding of the particularly powerful influence of teachers' views of their efficacy on low-achieving students. We also suggested that teachers who do not feel efficacious may be especially likely to communicate low expectations to low-achieving students. Perhaps it is also the case that teachers who feel efficacious are especially likely to communicate high expectations to low-achieving students.

This study provides evidence that changes in the classroom environment, in this case changes in teacher efficacy beliefs, from elementary to junior high school are related to changes in student beliefs about their performance and potential and about the difficulty of the subject matter, at least in the mathematics domain. Students who move into classrooms taught by teachers with a low sense of efficacy do show the commonly reported developmental decline in self and task beliefs after the transition to junior high school (e.g., Eccles et al., 1983; Harter, 1982; Thornburg & Jones, 1982). In contrast, students who move into classrooms taught by teachers with a high sense of efficacy show either less negative change or some positive change. Perhaps then, it is not inevitable that so many children suffer a decline in their motivation and performance when they move to junior high school. If most students moved to more efficacious teachers after the transition rather than to less efficacious teachers, developmental patterns of change in student motivation and performance would be somewhat different.

This study, using a quasi-experimental design, suggests that there is a causal relationship between teachers' beliefs about their personal efficacy and students' beliefs about their performance and potential in mathematics and the difficulty of the subject matter. However, in studies that are not "true" experiments, it is difficult to establish the causal direction of influence unequivocally.

It must also be pointed out that teacher efficacy is only one small piece of the puzzle. Although the effects of teacher efficacy reported here are highly significant, the sample is large and the magnitude of the effects is small. There are potentially many other changes in the environment in conjunction with the transition to junior high school that influence students' academic beliefs. In fact, in this study even students with high efficacy teachers in junior high school (Low/High and High/High) tended to experience some deterioration in their expectancies and perceived performance. The fact that this was less true in elementary school for students with high efficacy teachers (High/Low and High/High) points to other factors in the junior high school that are contributing to changes in students' beliefs. In a related study, we found that after the transition students are given fewer opportunities for decision making and for cooperative interaction with other students; whole class task organization

and the use of social comparison increase; and student/teacher relationships deteriorate (Feldlaufer et al., 1988). These differences should also impact negatively on student motivation and performance.

Brophy (1983) points out that while a great deal of research has been devoted to understanding the effects of teacher expectations on individual students, teachers' more generalized expectations for the class as a whole (closely related to beliefs about teaching efficacy) may have much more profound consequences for student motivation and achievement. "The potential for self-fulfilling prophecy effects is probably at least as great for these more general expectations as it is for expectations regarding specific individual students . . . and yet the development and functioning of expectations at this level have not received much attention" (Brophy, 1983, pp. 642, 655). This study not only adds to our understanding of the effects of generalized teacher beliefs, but also looks at the effects of changes in these beliefs across time and across the transition from elementary school to junior high school.

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